UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/714,325	11/15/2000	Sung-Bae Park	SAM-169	4343

7590 06/03/2004	EXAMINER
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ART UNIT	PAPER NUMBER
2183	

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *26 February 2004*.

2a) ☒ This action is **FINAL**.   2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *15 November 2000 and 26 February 2004* is/are: a)☐ accepted or b)☒ objected to by
the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f). ·

    a)☒ All   b)☐ Some * c)☐ None of:

        1.☒ Certified copies of the priority documents have been received.

        2.☐ Certified copies of the priority documents have been received in Application No. _____.

        3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   Claim 1 has been examined.

Papers Submitted

2.   It is hereby acknowledged that the following papers have been received and placed of record in the file: #8. Extension of Time as received on 2/26/2004 and #9. Amendment "A" as received on 2/26/2004.

Specification

3.   The abstract of the disclosure is objected to because of the following: References to the current routine and total accessing times should be replaced with more appropriate wording (see below). Correction is required. See MPEP § 608.01(b).

4.   The disclosure is objected to because of the following informalities:

In the amended paragraph on page 6, lines 8-12, please reword the portion regarding the current iteration loop counter so that it is more clear. More specifically, reword "a current iteration loop counter for counting the iterations a of a corresponding routine to generate a current iteration count" to --a current iteration loop counter for generating a current iteration count of a corresponding routine--. The applicant may reword this in a more desirable fashion instead of using the examiner's suggestion.

In the amended paragraph on page 6, lines 13-20, insert --in-- after "indicated".

In the amended paragraph on page 7, lines 5-12, change "total 12" to --a total of 12--.

Anything in the specification referring to the "current iteration loop counter" (or a similar name) should be changed to --current loop iteration counter-- because the system is counting iterations not loops.

Finally, anything in the specification referring to the "total iteration loop counter" (or a similar name) should be changed to --total loop iteration count-- because this component is not a counter (it does not count, it merely represents a total iteration count). Please correct the description regarding the functionality as well.

Appropriate correction is required.

Drawings

5.   The drawings are objected to because of the following minor informalities:

Fig.3 shows that routine 1 is executed 30 times. However, in Fig.4, instructions A and B only appear 20 times in the cache. Either add more A and B instructions to Fig.4 so that there are 30 of each, or modify Fig.3 to show that routine 1 is executed only 20 times (note that if this is done, the specification must be changed in all appropriate places to match the new Fig.3).

In Fig.5, replace "Current Access Loop Counter" with --Current Loop Iteration Counter-- and replace "Old Access Loop Counter" with --Total Loop Iteration Count--.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

6.   The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: Reference number 230

in Fig.9 has not been found in the specification by the examiner. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

7.   Claim 1 is objected to because of the following informalities:

The preamble of the claim is "A method of storing data in an address trace cache...". However, the final two paragraphs of the claim, as claimed, have nothing to do with storing data in an address trace cache. Please modify the preamble to something more appropriate.

In the paragraph involving the repeated instructions, the examiner asserts that repeatedly executing repeated instructions is redundant. This limitation should be reworded in a more appropriate fashion.

In the paragraph beginning with "providing...", insert --address-- before "trace cache" for increased clarity. Also, replace "current iteration loop counter" with --current loop iteration counter-- because the system is counting iterations not loops.

In the paragraph beginning with "providing...", replace "total iteration loop counter" with --total loop iteration count-- because this component is not a counter (it does not count, it merely represents a total iteration count, as shown in Fig.6). Also the last line of that paragraph states that the component is for "counting the total number of iterations of the routine of repeated instructions". This should be reworded to something more appropriate, as this count indicates the total number of times the loop is to be executed.

Appropriate correction is required.

Maintained Rejections

8.   Applicant has failed to overcome the rejections set forth in the previous Office Action.

Consequently, the rejections are respectfully maintained and copied below for applicant's

convenience (note that the rejections have been reworded to reflect the amendments made by

applicant).

Claim Rejections - 35 USC § 112

9.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the
> subject matter which the applicant regards as his invention.

10.   Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing

to particularly point out and distinctly claim the subject matter which applicant regards as the

invention. The repeated instructions (line 6) and the instructions to be executed (line 3) are not

distinguishable as presently claimed because a routine composed of repeated instruction is also a

routine composed of instructions to be executed. Therefore, it is not clear from the claim if the

address of each instruction should be stored in the cache (in the case of a routine of instructions

to be executed) or just the start and end addresses, a current iteration count, and a total number of

iterations. Applicant must distinguish these two types of routines such that it is clear whether the

address of each instruction is stored or whether the start and end addresses, a current iteration

count, and a total number of iterations is stored.

Claim Rejections - 35 USC § 103

11.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

12.   Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rotenberg et al.,

"Trace Cache: A Low Latency Approach to High Bandwidth Instruction Fetching," Proc. of the

29th International Symposium on Microarchitecture, Dec. 1996 (herein referred to as

Rotenberg), in view Kiuchi et al., U.S. Patent No. 5,579,493 (herein referred to as Kiuchi).

13.   Referring to claim 1, Rotenberg has taught a method of storing data in an address trace

cache in the environment of branch prediction comprising the steps of:

a) if a routine (dynamic instruction stream, Fig. 2) composed of instructions (a dynamic

instruction stream is composed of routines with unrepeated and/or repeated instructions in the

order of execution) is to be executed, storing an instruction of the dynamic instruction stream in

the trace cache according to an order of executed instructions (Fig. 2 and pg. 25, col. 1, 2nd

paragraph under section 1.1).

b) if a routine composed of repeated instructions is to be repeatedly executed, storing all the

repeated instructions of the dynamic instruction stream according to the order of execution (Fig.

2).

c) the difference between Rotenberg and the 1st step of claim 1 is that Rotenberg et al. stores

instructions in the trace cache while applicant claims storing the addresses corresponding to each

instruction in the place of instructions themselves in the trace cache. The difference between

Rotenberg and the 2nd step of claim 1 is that the applicant claims, if a routine of repeated

instructions is to be executed, storing a routine start address, a routine end address, a current

iteration count of the routine, and a total number of iterations of the routine instead of all the

instructions of the routine.

      c1) Kiuchi has taught a repeat control circuit for handling the execution of loops (Fig. 2),

which stores:

      1. The start address of the repeating instruction routine (element 214b),

      2. The total number of repeat steps in the routine (element 200), and

      3. The total number of times the loop is to be executed (element 207).

When the total number of repeat steps in the routine are executed, the repeat count register (207)

value is decremented (col. 7, line 37) by a down counter (208) and when its value becomes "1",

the repeated execution of the specified instruction module is ended (col. 10, lines 20-28).

Although the start address (214b) and the total number of repeat steps (200) in the routine can be

used to indicate the end of a routine (end of one iteration), one of ordinary skill in the art at the

time of the invention would have recognized that storing the end address of the routine can also

be used to indicate the end of the routine. Furthermore, it would have been obvious for one of

ordinary skill in the art at the time of the invention to indicate that all the iterations of the

specified routine are finished by storing and comparing the current number of iterations of the

routine with the total number of iterations (207) instead of decrementing the total number of

iterations.

      c2) One of ordinary skill in the art would have recognized at the time the invention was

made to store addresses corresponding to the instructions in place of the instructions themselves

in the trace cache to save cache area, as address bit lengths are smaller than instruction bit

lengths and as they can also be used to track the execution of a program. In addition, one of

ordinary skill in the art at the time the invention was made would have further been able to

recognize from Kiuchi, to use a repeat control circuit in conjunction with the trace cache

disclosed by Rotenberg, instead of storing all the repeat instructions to handle the execution of a

routine with repeated instructions (a loop) in order to reduce the number of instructions stored in

the trace cache and thus save trace cache area.

        c3) Hence, it would have been obvious to one of ordinary skill in the art at the time of the

applicant's invention, to modify the trace cache disclosed by Rotenberg by storing addresses

corresponding to the instructions in the trace cache and to store the start address, end address,

current access times, and total access times of the routine with repeated instructions as taught by

Kiuchi, in order to reduce the size of the trace cache.

d) Rotenberg fails to teach providing the trace cache with the loop counters for counting the

current and total iterations if a routine of repeated instructions is carried out. However, Kiuchi

has taught the use of loop counters (Fig. 2, elements 205 and 208). It would have been obvious to

one of ordinary skill in the art at the time of the applicant's invention to use loop counters in

order to count the current number of iterations and total number of iterations of a routine with

repeated instructions and hence reducing the size of the trace cache. More specifically, Kiuchi's

system is functionally equivalent to applicant's in that applicant's system counts up until a

predetermined number is met while Kiuchi's system counts down until a predetermined number

is met. The examiner asserts that it would have been obvious to one of ordinary skill in the art at

the time of the invention to modify Kiuchi to count up as opposed to counting down because this is functionally equivalent.

e) Rotenberg has taught addressing a start address (Fig. 4, fall-thru and target address), which will be accessed subsequent to the routine (trace) when a trace ends. Rotenberg has not taught that this access will occur when the current count and total count are identical. However, when a loop ends in Kiuchi, instructions subsequent to the loop will inherently be accessed. Therefore, because Rotenberg has been modified in view of Kiuchi, and Kiuchi has taught a system that is functionally equivalent to applicant's, it would have been obvious to one of ordinary skill in the art at the time of the applicant's invention to address a start address, which will be subsequent to the routine, when the values of the loop counters are identical to each other indicating the end of the routine.

Response to Arguments

14.   Applicant's arguments filed on February 26, 2004, have been fully considered but they are not persuasive.

15.   Applicant argues the novelty/rejection of amended claim 1 on page 11 of the remarks, in substance that:

> "Rotenberg is not related to using a trace cache for repeatedly executing a routine which includes a series of repeated instructions."

16.   These arguments are not found persuasive for the following reasons:

a) The examiner would like to point out page 25, column 2, lines 4-10. Rotenberg clearly teaches that the first time a series of instructions is encountered, the series will be stored in the

trace cache. Then, if the same series is to be repeatedly executed, it will be available in the trace

cache for more efficient fetching.

17.   Applicant argues the novelty/rejection of amended claim 1 on page 11 of the remarks, in

substance that:

> "Kiuchi does not teach a current iteration counter which keeps track of the current number of
> iterations that have been completed. Instead, to keep track of the number of iterations presently
> completed, Kiuchi teaches decrementing the total number of iterations to be completed. Thus,
> there is no storage of the total number of iterations of the routine to be completed."

18.   These arguments are not found persuasive for the following reasons:

a) The examiner asserts that Kiuchi teaches a system which is functionally equivalent to

applicant's system. That is, applicant stores the overall amount of times the loop should be

executed and then has a counter which counts up until that overall amount is achieved, thereby

ending the loop. Kiuchi teaches storing the overall amount of times the loop should be executed

and then decrements this value until a value of 1 is obtained, thereby ending the loop. Clearly,

both systems operate in a similar fashion and applicant has not provided proof that his/her

system offers some unexpected advantage over Kiuchi. Applicant's system counts up until a

predetermined number is met while Kiuchi's system counts down until a predetermined number

is met. The examiner asserts that it would have been obvious to one of ordinary skill in the art at

the time of the invention to modify Kiuchi to count up as opposed to counting down because this

is functionally equivalent.

Conclusion

19.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing

date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to David J. Huisman whose telephone number is (703) 305-7811.

The examiner can normally be reached on Monday-Friday (8:00-4:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Eddie Chan can be reached on (703) 305-9712. The fax phone number for the

organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

DJH
David J. Huisman
June 1, 2004

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SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100